## **CLAIMS**

## We claim:

An apparatus for condensing multi-component fluids comprising: 1. 1 2 a plurality of heat exchange stages, at least one scrubber, and 3 a plurality of mixers and splitters, 4 where the heat exchange stages and the at least one scrubber are interconnected in such a 5 way that streams are split and mixed so that a mixed stream enters each heat exchange stage 6 increasing a heat transfer coefficient in each of the heat exchange stages. 7 The apparatus of claim 1, where the plurality of heat exchange stages is two. 1 2. The apparatus of claim 1, where the plurality of heat exchange stages is three. 1 3. The apparatus of claim 1, where the plurality of heat exchange stages is four. 1 4. The apparatus of claim 1, where the plurality of heat exchange stages is more than four. 1 5. The apparatus of claim 1, further comprising a plurality of scrubbers, where the scrubber 6. 1 plurality is equal to or one less than the plurality of heat exchanger stages. 2 The apparatus of claim 6, where the heat exchange plurality is three and the scrubber 1 7. 2 plurality is two. The apparatus of claim 1, wherein the exchange stages are heat exchangers. 8. 1 9. An apparatus for condensing multi-component fluids comprising: 1 a first plurality of heat exchange stages, 2 3 a second plurality of scrubbers, a third plurality of mixers, and 4 5 a fourth plurality of splitters,

where the heat exchange stages and the scrubbers are interconnected in such a way that

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7 8		streams are split and mixed so that a mixed stream enters each heat exchange stage increasing a heat transfer coefficient in each of the heat exchange stages.		
1	10.	The apparatus of claim 1, where the plurality of heat exchange stages is two.		
1	11.	The apparatus of claim 1, where the plurality of heat exchange stages is three.		
1	12.	The apparatus of claim 1, where the plurality of heat exchange stages is four.		
1	13.	The apparatus of claim 1, where the plurality of heat exchange stages is more than four.		
1	14.	The apparatus of claim 1, further comprising a plurality of scrubbers, where the scrubber		
2	plura	plurality is equal to or one less than the plurality of heat exchanger stages.		
1	15.	The apparatus of claim 6, where the heat exchange plurality is three and the scrubber		
2 .	plura	plurality is two.		
1	16.	The apparatus of claim 1, wherein the exchange stages are heat exchangers.		
1	17.	A process for condensing multi-component fluids comprising the steps of:		
2		feeding an input vapor stream comprising a multi-component fluid to a condensation system		
3	of cla	of claims 1-16;		
4		splitting the input vapor stream into first and second vapor sub-streams;		
5		forwarding the first vapor sub-stream to a lower port of a scrubber;		
6		combining the second vapor sub-stream with a first scrubber liquid stream from a bottom		
7	port	port of the scrubber to form a first mixed stream;		
8		passing the first mixed stream through a first heat exchanger where it is fully condensed		
9	form	forming a first condensed stream;		
10		splitting the first condensed stream into first and second condensed sub-streams;		
1		combining the second condensed sub-stream with a first scrubber vapor stream from an		
12	uppe	upper port of the first scrubber to form a second mixed stream;		
13		forwarding the first condensed sub-stream to a top port of a scrubber;		

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14	counterflow compositionally equilibrating the first vapor sub-stream and the first condensed		
15	sub-stream in the scrubber, and		
16	passing the second combined stream through a second heat exchanger where it is fully		
17	condensed forming a final liquid stream comprising a multi-component stream having a		
18	compositions the same or substantially the same as the input stream,		
19	where the streams entering each heat exchanger are mixed streams having a composition		
20	designed to increase, optimize or maximize a heat transfer coefficient in each heat exchanger.		
1	18. The process of claim 17, further comprising the steps of:		
2	before the second splitting step, combining the first condensed stream with a second scrubber		
3	vapor stream from a port in a middle section of the scrubber to form a third mixed stream,		
4	passing the third mixed stream through a third heat exchanger where it is fully condensed		
5	forming a second condensed stream.		
1	19. The process of claim 17, further comprising the steps of:		
2 .	before the second splitting step, splitting the first condensed stream into third and forth		
3	condensed sub-streams,		
4	forwarding the forth condensed sub-stream to a port in a middle section of the scrubber;		
5	combining the third condensed sub-stream with a second scrubber vapor stream from a port		
6	in the middle section of the scrubber to form a third mixed stream,		
7	passing the third mixed stream through a third heat exchanger where it is fully condensed		
8	forming a second condensed stream.		
1	20. The process of claim 17, further comprising the steps of:		
2	before the second splitting step, combining the first condensed stream into second scrubber		
3	liquid stream from a port in a middle section of the scrubber to form a third combined stream,		
4	combining the third combined stream with a second scrubber vapor stream from another port		
5	in the middle section of the scrubber to form a third mixed stream,		
6	passing the third mixed stream through a third heat exchanger where it is fully condensed		
7	forming a second condensed stream.		

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1	21.	A process for condensing multi-component fluids comprising the steps of:		
2		feeding an input vapor stream comprising a multi-component fluid to a condensation system		
3	of cla	of claims 1-16;		
4		splitting the input vapor stream into first and second vapor sub-streams;		
5		forwarding the first vapor sub-stream to a lower port of a first scrubber;		
6		combining the second vapor sub-stream with a first scrubber liquid stream from a bottom		
7	port o	of a second scrubber to form a first mixed stream;		
8		passing the first mixed stream through a first heat exchanger where it is fully condensed		
9	form	ing a first condensed stream;		
10		combining the first condensed stream with a first scrubber vapor stream from a port in a		
11	midd	le section of the first scrubber to form a second mixed stream,		
12		passing the second mixed stream through a second heat exchanger where it is fully		
13	cond	ensed forming a second condensed stream		
14		splitting the second condensed stream into first and second condensed sub-streams;		
15		combining the second condensed sub-stream with a second scrubber vapor stream from an		
16	uppe	r port of the second scrubber to form a third mixed stream;		
17		forwarding the first condensed sub-stream to a top port of the first scrubber;		
18		forwarding a second scrubber liquid stream from a bottom port of the first scrubber to a top		
19	port	of the second scrubber,		
20		forwarding a third scrubber vapor stream from an upper port of the first scrubber to a lower		
21	port	of the second scrubber,		
22		counterflow compositionally equilibrating the first vapor sub-stream and the first condensed		
23	sub-s	stream in the first scrubber,		
24		counterflow compositionally equilibrating the second scrubber liquid stream and the third		
25	scrub	ober vapor stream in the second scrubber, and		
26		passing the third mixed stream through a third heat exchanger where it is fully condensed		
27	form	ing a final liquid stream comprising a multi-component stream having a compositions the same		
28	or su	bstantially the same as the input stream,		
29		where the streams entering each heat exchanger are mixed streams having a composition		
30	desig	gned to increase, optimize or maximize a heat transfer coefficient in each heat exchanger.		

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2		before the second splitting step, combining the first condensed stream with a second scrubber		
3	vapo	vapor stream from a port in a middle section of the scrubber to form a third mixed stream,		
4		passing the third mixed stream through a third heat exchanger where it is fully condensed		
5	form	forming a second condensed stream.		
1	23.	The process of claim 21, further comprising the steps of:		
2		before the second splitting step, splitting the first condensed stream into third and forth		
3	cond	condensed sub-streams,		
4		forwarding the forth condensed sub-stream to a port in a middle section of the scrubber;		
5		combining the third condensed sub-stream with a second scrubber vapor stream from a port		
6	in the	in the middle section of the scrubber to form a third mixed stream,		
7		passing the third mixed stream through a third heat exchanger where it is fully condensed		
8	form	forming a second condensed stream.		
1	24.	The process of claim 21, further comprising the steps of:		
2		before the second splitting step, combining the first condensed stream into second scrubber		
3	liqui	liquid stream from a port in a middle section of the scrubber to form a third combined stream,		
4		combining the third combined stream with a second scrubber vapor stream from another port		
5	in the	in the middle section of the scrubber to form a third mixed stream,		
6		passing the third mixed stream through a third heat exchanger where it is fully condensed		
7	form	forming a second condensed stream.		

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